

Speed Control Of D.C Motor Using PWM

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Abstract- The aim of the experiment is to control the speed of d.c motor using pwm (pulse width modulation) technique using 555 timer.

I. OBJECTIVE

The objective of the experiment is to control the speed of d.c motor using 555 timer. Here the speed control is done by generating a pwm wave by the 555 timer.

II. APPROACH

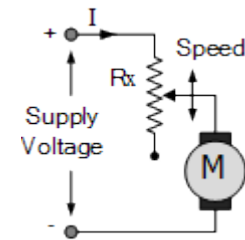
A. D.C MOTOR:

A DC motor consist basically of two parts, the stationary body of the motor called the Stator and the inner part which rotates producing the movement called the Rotor. For D.C. machines the rotor is commonly termed the Armature.

Small DC motors ideal for use in applications where speed control is required such as in small toys, models, robots and other such electronics circuits.

B. SPEED CONTROL OF D.C MOTOR:

The rotational speed of a DC motor (N) is proportional to the back emf (V_b) of the motor divided by the magnetic flux (which for a permanent magnet is a constant) times an electromechanical constant depending upon the nature of the armatures windings (K_e) giving us the equation of: $N \propto V/K_e\phi$.



Speed control method of d.c motor

We control the flow of current through the motor. Well many people attempt to control the speed of a DC motor using a large variable resistor (Rheostat) in series with the motor .

C. NEED FOR OTHER APPROACH:

While this may work, as it does with Scalextric slot car racing, it generates a lot of heat and wasted power in the resistance.

D. USE OF PWM TECHNIQUE:

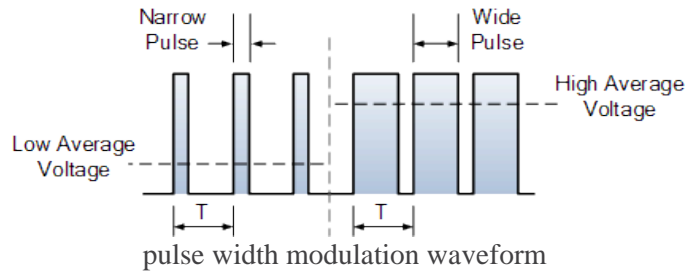
One simple and easy way to control the speed of a motor is to regulate the amount of voltage across its terminals and this can be achieved using **Pulse Width Modulation** or PWM.

As its name suggests, pulse width modulation speed control works by driving the motor with a series of “ON-OFF” pulses and varying the duty cycle, the fraction of time that the output voltage is “ON” compared to when it is “OFF”, of the pulses while keeping the frequency constant.

The power applied to the motor can be controlled by varying the width of these applied pulses and thereby varying the average DC voltage applied to the motor terminals. By changing or modulating the timing of these pulses the speed of the motor can be controlled, ie, the longer the pulse is “ON”, the faster the motor will rotate and likewise, the shorter the pulse is “ON” the slower the motor will rotate.

In other words, the wider the pulse width, the more average voltage applied to the motor terminals, the stronger the magnetic flux inside the armature windings

and the faster the motor will rotate and this is shown below.



E. USE OF 555 TIMER FOR GENERATING PWM WAVE.

[NE555](#) or 7555 timer chip is used to produce the required pulse width modulation signal at a fixed frequency output. The timing capacitor C is charged and discharged by current flowing through the timing networks R_A and R_B .

The output signal at pin 3 of the 555 is equal to the supply voltage switching the transistors fully ON. The time taken for C to charge or discharge depends upon the values of R_A , R_B .

The capacitor charges up through the network R_A but is diverted around the resistive network R_B and through diode D_1 . As soon as the capacitor is charged, it is immediately discharged through diode D_2 and network R_B into pin 7. During the discharging process the output at pin 3 is at 0 V and the transistor is switched OFF.

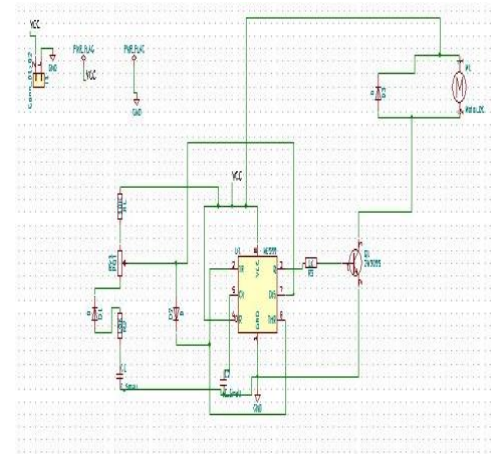
III. EDA TOOL USED

The EDA tool used by us is Kicad.

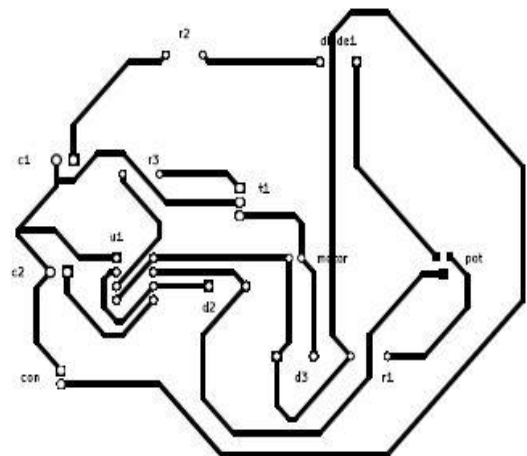
Kicad is an open source EDA tool which is used by us to design the schematic and layout of the pcb.

We have also it for routing tracks on our pcb.

IV. SCHEMATIC



V. PCB LAYOUT



VII. CONCLUSION

The implemented circuit thus controls the speed of a dc motor using pwm generated by a 555 timer.

Pulse width modulation is a great method of controlling the amount of power delivered to a load without dissipating any wasted power.

Also the controlling of the speed of dc motor is done by using a 100k pot. So whenever we need a low speed

i. SPEED CONTROL OF FAN:

By using the concept of pwm wave generation using 555 timer, we control the speed of the fan. The only thing we need to do is, we need connect a fan at the output terminal of the implemented circuit.

ii. DIM THE BRIGHTNESS OF LAMP:

The above implemented circuit can be also used to dim the brightness of lamp/led. For this again we need to connect a lamp/led at the output end of the circuit.

iii. MOTION CONTROL OF TOYS:

The above implemented circuit can be used to control the motion of toys, when such circuit is fitted inside a toy and the pot can be considered as an input, thus by varying it the motion of the toy starts.

the pot is kept at lowest position and when it is highest position we get the highest speed of the motor.

Also by using this circuit we have eliminated the problem of power dissipation in the conventional circuit

VIII. APPLICATIONS

REFERENCES:

- 1) <http://www.electronicstutorials.ws/blog/pulse-width-modulation.html>
- 2) <https://www.electrical4u.com/>